RODENT
Newsletter

Vol. 20(1) 1996

ALL INDIA COORDINATED RESEARCH PROJECT ON RODENT CONTROL

CENTRAL ARID ZONE RESEARCH INSTITUTE,
JODHPUR 342 003

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Population of Bandicoot Rat, Bandicota bengalensis Gray

A.S. BHADAURIA AND Y.K. MATHUR

C.S. Azad University of Agriculture & Technology, Kanpur 208 002 (U.P.)

With a view to study the population dynamics of bandicoot rat, *B. bengalensis* in Kalyanpur block, distt. Kanpur, ten burrows of this species were dug out per month for consecutive three years from 1986 to 1989. The population of targetted species was determined on the basis of number of individuals/burrows/months.

It may be inferred from the table that to over all mean population of bandicoot rats recorded during three years of study was found maximum in the month of March (5.10/burrow) followed by November (4.70/burrow) and January (4.28/burrow), while in the month of February 1.00/burrow), July (1.00/burrow) and June (1.09/burrow), it remained at low ebb. The mean population for burrow ranged from 1.00/burrow to 5.10/burrow during all the year round. Interestingly, adult bandicoots were found to live singly irrespective of sex during the course of this study.

Table : Mean Population of *B. bengalensis* in Kalyanpur block, Kanpur.

Months	Mean No. of bandicoots per burrow			Total	Average No. of bandicoots per burrow
	1986-87	1987-88	1988-89		
July	1.00	1.00	1.00	3.00	1.00
August	1.57	2.00	1.76	5.33	1.77
September	2.62	2.10	1.90	6.62	2.20
October	2.97	3.12	2.67	8.76	2.92
November	4.21	5.12	4.78	14.11	4.70
December	3.25	3.00	4.12	10.37	3.45
January	4.00	4.23	4.62	12.85	4.28
February	1.00	1.00	1.00	3.00	1.00
March	5.00	4.97	5.33	15.30	5.10
April	3.71	2.60	2.97	9.28	3.09
May	2.62	1.78	2.13	6.58	2.14
June	1.00	1.06	1.23	3.29	1.09

Rodent Communities at Various Altitudes in the Aravallis

ISHWAR PRAKASH AND PARTAP SINGH
Desert Regional Station, Zoological Survey of India, Jodhpur-342009

Rodents were snap-trapped from Abu hill and the main Aravalli range from 1993 to 1995. Out of 1104 small mammals trapped, 176 were insectivores (*Suncus murinus not in itable Suncus stoliczkanus*) and rest belonged to order rodentia. Abu hill, the highest in Aravallis, was occupied by 12 species of rodents while the main Arvalli range harboured only 11 species. The trap lines were laid in 7 habitats at 4 altitudes and the rodent communities varied considerably at various elevations.

Maximum number (33.73 percent of total rodent collection) of rodents were collected from highest work spots i.e. 1500-1600m altitude and after *Cremnomys cutchicus* major rodent species of the elevation were: *Golunda ellioti, Tatera indica, Rattus rattus* and *funambulus pennanti. Mus terricilor, Vandeleuria oleracea, Mus saxicola* and *B. bengalensis* occur in low frequency at this altitude, while *Millardia meltada* was altogether absent.

Next most preferred elevation was the foothills, from where 27.26 per cent rodents were entrapped. The species collected at this elevation in order of abundance were : *M. meltada, G. ellioti, T. indica, C. cutchicus* and *F. pennanti.* The foothills exhibited maximum species richness among all the four altitues, as all the 12 species occurred here as compared to hills at 1500-1600 elevation from where 11 species were collected. The elevation of 1000-1100 m was preferred by as many species as the highest elevation and 500-600 m was least species rich inhabited by only 10 species. Third most occupied altitude was 1000-1100 m which yielded 24.57 per cent of total rodent collection. Following *C. cutchicus* in order of abundance were *F. pennanti, G. ellioti, B. bengalensis* and *Mus phillipsi.* The rodent species absent from this elevation was *V. oleracea.* Last in order or occupancy was 500-600 m altitude, harbouring only 14.44 per cent of rodents, *C. cutchicus, T. indica, R. rattus* and *F. pennanti* were preponderant and *M. platythrix, G. ellioti* and *B. bengalensis* rare species of altitude. *M. saxicola* and *M. terricolor* were altogether absent from this elevation.

The rodent communities, as per their abundance, at various altitudes were found to be:

Foothills (27.26%) : *M. meltada, G. ellioti, T. indica, C. cutchicus*

500-600m (14.44%) : *C. cutchicus, T. indica, R.rattus,. F. pennanti*

1000-1100m (24.57%) : *C. cutchicus, F. pennanti, G. ellioti, B. bengalensis.*

1500-1600m (33.73%) : *C. cutchicus, G. ellioti, T.indica, R.rattus.*

Versatility of Cutch rock-rat, *Cremnomys cutchicus*

PARTAP SINGH AND ISHWAR PRAKASH
Desert Regional Station, Zoological Survey of India, JODHPUR - 342 009.

The Cutch rock-rat, *Cremnonys cutchicus* is discontinuously distributed in India. It occurs on all the hilly outcrops scattered in the Thar desert and on the Aravalli ranges. It has been conjectured that it was continuously distributed on the Aravalli in entire Rajasthan prior to deposition of sand in the desert.

On the hilly outcrops in the desert viz. Barmer, Jaisalmer,Jhunjhunu, Sikar; it is the sole rodent inhabitant of rocky system, whereas at some localities its sympatric species is *Mus Phillipsi* which is associated with massive shrubs of *Euphorbia caducifolia.* On the Aravalli range, however, this crevice-dwelling nocturnal rodent competes with 13 small mammalian species and is the most predominant species in almost all the habitats and altitudes of montane ecosystem. The recently introduced irrigated crop fields in the Aravalli ranges are protected by erecting loose stones on the periphery. This versatile rodent has altered its ecological niche from rock crevices to voids between loosely piled stones. As a consequence a wild, rock-loving rodent has turned into an abundant pest of food crops. Since the farmhouses are situated within the crop fields over the hills, it has been trapped from the houses as well. If this trend continues, it is feared that this sylvatic rodent will turn into a commensal species.

Earlier studies have revealed that *C. cutchicus* prefers to feed upon flowers of trees and shrubs in the desert region.On the Aravalli mountains, where it is found in abundance, about 200 per hectare, it turns into an omnivore.

The stomach content analysis has revealed that this phytophagous rodent also feeds on fishes, probably because they are available to them in runnels and rivulets. Eight insect orders have also been recorded from the stomachs of this rodent species. A termite, *Odontotermes redemanni* reported only from south India, was also found in one of the stomachs. Through this study *O. redemanni* is being reported for the first time from Aravallis. Bark of stems of trees and shrubs has been found in stomachs of rock-rats to an extent that this rodent must be inflicting severe damage to the forest vegetation.

A striking differences have been noticed in the reproductive performance of *C. cutchicus* inhabiting the xeric and montane environments. It breeds almost all the year round in the desert but a restricted littering activity has been noticed on the Arvallis, lasting from February to September. Peak breeding activity in desert population was during post-monsoon period. However, the prevalence of pregnancy in the desert population fluctuated between 5 to 90 percent. Whereas on the Aravalli ranges the variance was from 18 to 100 percent. Likewise, a higher litter size has been observed in females inhabiting the hill ecosystem, 3 to 10 (av. 5.23). In the arid region the litter size is smaller 2 to 8 (av. 4.03).

The significant variance in habitat preference, survival strategies, food habits and reproductive potential of *Cremnomys cutchicus* inhabiting two bioclimatological zones clearly indicate the versatility of the species.

Seasonal Population Distribution of Bandicoot Rat, *Bandicota bengalensis* Gray and Indian Gerbil, *Tatera india indica* Hardwicke.

A.S. BHADAURIA AND Y.K. MATHUR
Department of Entomology,
C.S. Azed University of Agri. & Tech., Kanpur 208002

With a view to workout the seasonal population fluctuation of *B. bengalensis* and *T. indica* in relation to type and topography of soil which are major species of field rodents in central Uttar Pradesh, the present studies were undertaken during 1988-89 at five locations of Kalyanpur Block Kanpur. The data presented in the Table indicate that during summer (March to June), the population of *B. bengalensis* was higher in villages Gangpur and Prempur having clay loam soil than in village Singhpur and Baikunthpur where the soil is sandy loam. During rainy season (July to October), the population of *B. bengalensis* decreased in the villages Gangpur and Prempur which get submerged in water, whereas correspondingly it increased in villages Singhpur and Baikunthpur which are situated at higher elevations.

Some migration of the population of *T. indica* from submerged areas to upland areas during the rainy season was also observed. Thus, the population of rodents on higher elevation in the rainy season gets considerably increased due to migration from low lying areas.

In winter season (November to February) bandicoots again manifested the same distribution pattern as observed during summer in respect of soil type. In villages Baikunthpur and Singhpur which possess sandy loam soil, the population of *T. indica* was higher than *B. bengalensis*, while in villages Prempur and Gangpur having clay loam type soil, the population of *B. bengalensis* was higher than *T. indica*. It is, thus, clear from these studies that *B. bengalensis* and *T. indica* preferred clay loam and sandy loam soil, respectively for their abode.

Table : Seasonal Population distribution of *B. bengalensis* and *T. indica* in relation to type and topography of soil in Kalyanpur block, Kanpur

Village	Type and Topography of soil	Number of field rodents in 4 hectares of land in different months					
		SUMMER (March to June)		MASOON (July to Oct.)		WINTER (Nov. to Feb.)	
		B. bengalensis	*T. indica*	*B. bengalensis*	*T. indica*	*B. bengalensis*	*T. indica*
Gangpur	Clay loam submerged	38	14	9	13	64	11
Prempur	Sandy loam submerged	31	15	9	11	32	14
Baikunthpur	Sandy loam upland	6	52	43	64	18	57
Ishwariganj	Sandy clay submerged	23	33	12	4	25	15
Singhpur	Sandy loam plains	13	54	63	62	21	53

Some Observations on Population of Indian Gerbil, *Tatera indica indica* Hardwicke

A.S. BHADAURIA AND Y.K. MATHUR
C.S. Azad University of Agriculture & Technology, Kanpur 208 002 (U.P.)

Keeping in mind the prolific breeding potentiality of *T. indica*, a comprehensive study during 1986-1989 was undertaken to determine the population dynamics of this species in Agro-ecosystem of Kalyanpur block, distt. Kanpur on the basis of number of individuals/burrow/month.

It is obvious from the table that over all mean population of gerbils recorded during three years of study showed an increasing trend from July 3.15/burrow) to Novmeber (7.32/burrow) thereafter a decreasing trend, reaching a level in January, the average being (2.76/burrow). The population of gerbil influxed again from Februa.y (3.39/burrow) to April (3.78/burrow). Following this, the population of gerbils declined during May and June, the average being 2.96 to 2.89/burrow, respectively. It is, thus, concluded that the gerbil population remained at low ebb. during January, May and June and increased in the months of October Novmeber.

Table : Mean population of *T. indica*.

Months	Mean No. of gerbils per burrow			Total	Average No. of gerbils per burrow
	1986-87	1987-88	1988-89		
July	3.30	2.28	3.87	9.45	3.15
August	4.40	5.89	3.93	14.22	4.74
Septmeber	4.83	5.16	4.67	14.66	4.88
October	4.60	5.58	6.00	16.18	5.39
Novmeber	8.57	7.00	6.40	21.97	7.32
December	3.80	5.88	4.17	13.85	4.61
January	2.20	2.66	3.43	8.29	2.76
February	4.25	2.76	3.18	10.19	3.39
March	4.60	3.40	3.20	11.20	3.73
April	3.00	3.44	4.90	11.34	3.78
May	2.80	4.10	2.00	8.90	2.96
June	2.60	4.77	1.30	8.67	2.89

Impact of Germination on The Food Consumption and Preferences of Indian Mole Rat, *Bandicota Bengalensis* (Gray)

V. VANITHA, P. NEELANARAYANAN AND R. KANAKASABAI
Division of Wildlife Biology, A.V.C. College Mayiladuthurai (Tamilnadu)

Success of any rodent control campaign through rodenticides lies in the acceptance of poison bait by target species. To accomplish this, determination of species specific bait bases are important to control different species of rodents' menace in an effective way in the crop fields. In view of this, an attempt was made to study the food consumption and preference between germinated over non- germinated cereals viz., rice, pearl millet and ragi (Bi-choice tests) individually. Similarly, a multiple choice test was also conducted among the germinated rice, pearl millet and ragi. The lesser bandicoot rat, *Bandicota bengalensis*, a predominant rodent pest in Cauvery delta was subjected to this study.

Bi-choice Test:

The tests conducted for five consecutive days revealed that the Indian mole rat, *B. Bengalensis* preferred germinated cereals such as rice, pearl millet and ragi over their non-germinated forms and they were statistically significant ($P < 0.05$). The overall order of preference of the germinated cereals, in terms of weight (g) was found to be rice > pearl millet > ragi. However, overall mean per cent increase in the intake of germinated cereals over non-germinated were 47.83 for rice, 41.56 for pearl millet and 56.78 for ragi. These differences in the consumption may be due to the palatability and texture of the germinated cereals.

Multiple Choice Tests

The results of five successive days in the multiple choice test indicated that preferential order of intake of germinated cereals were pearl millet > rice > ragi. Although, the difference was observed to be statistically insignificant (One way ANOVA; $P > 0.01$). in the ingestion of germinated cereals.

Series of bi-choice and multiple choice tests carried out in the present study revealed that the germinated cereals can very well be suggested as a poision bait carrier, preferably in the order of rice= pearl millet and ragi for the control of *B. bengalensis*.

Distribution of Rodent Burrows in Harvested Paddy Fields

O.P. DUBEY AND G.S. THAKUR
Jawaharlal Nehru Krishi Vishwa Vidhyalaya, Jabalpur 482 004 (M.P.)

Paddy is severely attacked by rodents during crop growth period in Kymore plateau and Satpura Hill region of Madhya Pradesh. However, more severe damage is found at preharvesting stage. Distribution of rodent burrows in paddy field is very much important for effective protection of paddy crop from rodent damage. Hence, study was conducted for determination of most injurious and spatial distribution of rodent species at JNKVV, farm, Jabalpur during 1995. The active burrows in different areas (bund, field border and field) were recorded specieswise by counting opened burrows after plugging on the previous day. The recorded species of rodents were classified on the basis of their burrow characteristics.

The mean burrow population of three different rodent species at 3 locations in double cropping system, reveded dominama of *B. bengalensis* (59.26%) followed by *M. meltada* (27.51%) and *Mus booduga* (13.22%).

The spatial distribution of burrows, i. e. mean number burrows of rodents/ha was recorded to be maximum (48.03) on bunds followed by(22.06). in fields Minimum burrows, 4.92/ha was recorded in the border area of the harvested paddy fields. Thus in case of paddy crop, the burrows of rodents remained maximum on bunds and minimum in bordered crop area under irrigated condition. With regard to burrowing, *B. bengalensis* remained highly active on all the observed areas of the fields. Similar behaviour was also noticed with *M. meltada* while in case of *M. booduga*, burrowing activity was more in field and least border area after harvest of paddy crop.

Thus the observation suggested that control of rodents should be done on bunds as well as in the fields immediatey after harvest of paddy crop. This operation will help in checking the further rodent infestation in the next crop.

Table 1. Spatial distribution of rodent burrows in harvested paddy fields

Location	Number of burrow per hectare											
	Bund			Field Border			Field			Total Burrows		
	B.b.	M.m.	M.b.	B.b. M.m. M.b.			B. b.	M.m.	M.b.	B. b.	M.m.	B.b.
I.	13.50	11.77	4.21	0.00	0.78	1.31	3.07	4.56	6.75	16.57	17.11	12.27
II.	29.71	16.66	2.83	3.61	0.79	0.93	9.11	8.64	11.63	42.43	26.09	15.44
III.	51.36	13.18	0.90	5.90	0.00	0.00	15.90	3.63	0.90	73.16	18.17	1.80
Mean	31.52	13.87	2.64	3.17	0.97	0.78	9.36	6.27	6.42	44.05	20.45	9.82

B.b. = Bandicota bengalensis; M.m. = Milarawa meltada; M.b. = Mus booduga

Rat Problem in Rabbit Houses

V.R. PARSHAD
Department of Zoology, Punjab Agricultural University, Ludhiana 141004,

Rabbit farming for wool and meat is receiving attention among rural communities as good source of income in Punjab. One of the major problem which appear to decrease profits is the development of large rodent population in rabbit houses which provide them good harbourage site and abundant availability of food. Rats eat pellets of commercial rabbit feed and gnaw the corners of wooden structures, windows and doors, contaminate cages and floor of the rabbit house premises with faecal pellets and urine. They also contaminate the rabbit feed with faecal pellets, urine and hairs. In two rabbit houses rats were reported to have injured and killed the young ones in maternity cages where the mothers were not able to protect the young ones from attack by rats. In a rabbit house on the campus of Punjab Agricultural University where the rabbits are being bred for experimental purposes, 6 closed containers (Robox) each with 20 grams of 2% zinc phosphide bait were placed for controlling rats for 2 days. With this treatment 29 dead house rats (*Rattus rattus*) were retrieved: 16 were recovered on day 1 and 3 on day 2. On day 3 that is one day after the treatment 6 dead rats were recovered from the concealed places below the boxes and 4 were found dead on the ground. Observations of the rodent problem and control suggested

that rat proofing techniques and control with rodenticides in closed containers need to be adopted to tackle rat problem in rabbit houses.

Rodent Damage to Oyster Mushroom Crop in Meghalaya

D. KUMAR
ICAR Research Compex for NEH Region
Umroi Road, Barapani 793103 (Meghalaya.)

Oyster mushroom (*Pleurotus sp.*) is the second most important cultivated mushroom in terms of global mushroom production. It is generally grown under indoor conditions. In North Eastern Hill Region, low cost thatched house, made up of bamboo mats, having mud plastered floor is commonly used for growing oyster mushroom. This type of housing has been found economical and ideal for mushroom cultivation but prone to rat *damage.*

Rats are known to damage button mushroom (*Agaricus bisporus*) crop by digging the casing soil in mushroom trays. However, for the first time paddy straw blocks used for cultivation of oyster mushroom were found to be damaged by rats at Barapani. *Bandicota bengalensis* was found associated with damage of strawblocks. It made holes in straw-blocks and disturbed the mycelial run, which resulted in total crop failure.

Out of 36 seeded strawblocks, 6 were damaged bybondicoots. The cost of making one paddy strawblock of size 8x25x50 cms including the cost of spawn (seed material for growing mushroom) works out to be about Rs. 15/- Each block produces about 1 kg of fresh mushroom, which sell for about Rs. 35.40 per Kg. Thus the damage caused by rats to each block results in direct loss of Rs. 15/- per block and potential loss of Rs. 20 - 25 per block depending on market value of the crop.

Rodent damage to Straw blocks

Probably, maize grain 'spawn' which was used as seed material might have attracted the rats. To overcome the problem following poison baits were used in mushroom house :

	Posion bait	Consumption of bait (%)
1.	Rice based poison bait of Zinc phosphide (2%)	20%
2.	Maize grain "spawn" based poison bait of zinc phosphide (2%)	60%
3.	Bromadiolone (0.005%) ready-to-use wax cake.	10%

It was observed that maize grain 'spawn' based zinc phosphide bait was preferred over other two baits. No. incidence of rat damage was observed after the above treatment i : mushroom house. Further, research is in progress.

Rodent Problem in Bee Keeping in Meghalaya

A.N. SHYLESHA, MAHESH KUMAR AND N.S. AZAD THAKUR
ICAR Research Complex for N.E.H. Region,
Umroi Road, Barapani 793103 (Meghalaya)

Rodents inflict collosal damage to various crops, commodities, stored products etc. Besides these it has been observed for the first time at Barapani, Meghalaya (25° 30' N lattitude and 91° 51' E longitude and altitude 980–1080 msl) that Mus-spp. was devoured bees was and caused considerable damage to broad and super chamber was combs (Fig.). Approximately 6-7 super frame combs were completely gnawed by Mus- and a nest was made inside the hive using straw and green grasses. A good colony of Apis-cerana- indica F. takes 3-4 months in honey flow season to construct 6-7 super frame

Bee Combs: damaged by Mus spp.

combs which were damaged by the mouse in a day only. More damage was observed when the bee hives were kept in uncleared areas. The continuous movement of the mice disturbed the bee colonies which resulted in the complete dertruction of the hive.

Squirrel Damage in Sugarcane

D.C. SRIVASTAVA
Indian Institute of Sugarcane Research, Lucknow 226 002

Squirrel damage in sugarcane is reported but not so well documented. A look to the sugarcanes, grown in microplots, in the compound of Radio Tracer Lab of this Institute revealed heavy damage due to squirrels. Since the canes grown belonged to eight varieties which are promising and commercial, grown as a plant crop in randomised and replicated pattern and the squirrels had free access to all of them, opportunity was availed to record damage thereon. It was scored on wholeplot basis around the cane harvest stage during 1992-93 and 1993-94. The average data on the incidence of this damage (Table 1) clearly revealed that all the varieties were damaged but their degrees varied. Varielty CoLK 7810 recorded highest damage (81.57%) and variety CoS 767 the lowest (25.63%). The other varieties which included Co 1148, CoS 802, CoLK 8001, Co 997, CoJ 64 and CoS 687 in the descending sequence ranged within 40 to 54 percent. Variety CoS 767 has, interestingly, proved fairly tolerant to rat attack also like squirrels. This damage was mostly confined to basal internodes like that due to rats. Weight loss in damaged cane was estimated to an extent of 17.69% over undamaged canes.

Table 1 Incidence of damage due to squirrels in sugarcane

Variety	Incidence of damage (%)
CoLK 7810	81.57
Co 1148	54.40
CoS 802	50.62
CoLK 8001	50.15
Co 997	49.70
CoJ 64	47.60
CoS 687	40.19
CoS 767	25.63

Thus these data clearly indicated that variety CoS 767 should be encouraged in the areas which are adjoining the trees and where squirrels generally pose problem.

COLK 8102 : A Rat Tolerant Variety of Sugarcane

D.C. SRIVASTAVA
Indian Institute of Sugarcane Research, Lucknow 226 002

It was observed during rodenticidal trials at the IISR farm, Lucknow that despite good rat population in number of sugarcane fields of variety COLK 8102 damage was difficult to find. This interesting observation prompted further investigation in this regard. A field of sugarcane was, thereafter, identified which had this variety grown alongwith two more varieties namely Co 1148 and CoLK 8001. This field too had fairly good rat population. Assessment of damage was carried out at the harvest stage by examining a total of 300 canes at random (20 canes at each of 15 spots) from each variety. These data revealed only one damaged cane out of 300 canes of variety CoLK 8102 whereas it was 13.33 and 12.33 percent in varieties Co 1148 and CoLK 8001 respectively. These data clearly showed that the field rats are not able to damage the canes of variety CoLK 8102. This could apparently be due to hardness of its canes. Thus this variety should be very useful for solving rodent problem in sugarcane atleast in North west zone of this country where it has been released.

Evaluation of Some Newer Rodenticides Against Field Rodents Under Laboratory Conditions

A.S. BHADAURIA AND Y.K. MATHUR
Department of Entomology,
C.S.Azed University of Agri. & Tech., Kanpur 208 002

The bio-efficacy tests of three new generation rodenticides were conducted against, bandicoot rats, *Bandicota bengalensis* Gray and Indian gerbil, *Tatera indica indica* Hardwicke in the laboratory. The rodenticides were tested at three exposure periods (1, 2 and 3 days) against targetted species. After

the desired poison exposures, the animals were kept on normal diet till death, Water was provided *ad liblitum.*

The data presented in the Table revealed that brodifacoum (0.005%, Ready Poison Bait) knocked down all the gerbils in two as well as three days poison exposure, while bandicoots succumbed to the poison leading cent per cent kill even in single day exposure. The flocoumafen (0.005% R.P.B.) manifested cent per cent kill of *B. bengalensis* and *T. indica* in two and three days of poison exposure periods. The cholecalciferol (0.075% R.P.B.) registered 100 per cent kill of *B. bengalensis* only after three days of poison exposure, wuile all *T. indica* died in one day exposure.

Table : Bio-efficacy of newer rodenticides to field rodents in no choice tests under laboratory conditions. (RPB = Ready Poison Bait)

Rodenticides	Poison exposure period (day)	*B. Bengalensis*			*T. india*		
		per cent mortality	Days mean	to death (Range)	per cent mortality	Days Mean	to death (Range)
Brodifacoum (0.005% R.P.B.)	1	100	6.93	(5–11)	65	7.57	(5–12)
	2	100	6.21	(4–7)	100	6.37	(4–10)
	3	100	5.79	(4–6)	100	6.25	(4–10)
Flocoumafan (0.005% R.P.B.)	1	60	5.42	(8–10)	65	6.50	(6–7)
	2	100	8.21	(7–10)	100	8.00	(6–9)
	3	100	8.45	(6–9)	100	8.33	(7–11)
Cholecalciferol (0.075% R.P.B.)	1	60	8.30	(6–13)	100	3.00	(3–4)
	2	72	7.61	(5–11)	100	3.65	(3–5)
	3	100	6.95	(4–10)	100	3.30	(3–4)

Contributions for inclusion in the Newsletter may please be forwarded along with 1-2 good black and white photographs to :

Project Coordinator,
AICRP on Rodent Control,
Central Arid Zone Research Institute,
JODHPUR 342 003

Published by the Director, CAZRI, Jodhpur and Printed by Cheenu Enterprises
Jawari Bhawan, High Court Colony, Jodhpur 342 011 Tel. 23023